BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED

"Selection of Service Provider for Sale of Smart Meters to prospective consumers on rate contract basis in retail outlets for arranging power supply to new connections (including temporary installations) along with Supply, Implementation, Commissioning of IT system for a period of 5 years & Maintenance of IT system for a period of 10 years in BESCOM Jurisdiction." vide Tender Enquiry No. BESCOM/2024-25/SE0193

Annexure A
Technical Specifications

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Annexure A1

Technical Specifications for Whole Current A.C. Single Phase Smart Energy Meter

Scope

These specifications cover the design, manufacturing, testing, supply and delivery of AC whole current, single phase, 2 wires Smart Energy Meter with bidirectional communication facility & remote connect/disconnect switch. The meter shall communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1, as per the requirement of the utility.

Basic Features

The Smart Meter would have the following minimum basic features-

- Measurement of electrical energy parameters
- Bidirectional Communication
- Integrated Load limiting /connect/disconnect switch
- Tamper event detection, recording and reporting
- Power event alarms as per IS 16444 Part 1
- Remote firmware upgrade
- Pre-paid features at MDM end (as per IS 15959 Part 2)
- TOD features
- Net Metering(kWh) features (optional as per requirement of utility)
- On demand reading

General standards applicable for meters

S. No.	Standard No.	Title
1	IS 13779 with latest amendments	AC Static Watt-hour Meter class 1& 2
2	IS 15884 with latest amendments	Alternating Current Direct Connected Static Prepayment Meters for Active Energy (Class 1 ar 2)-Specification
3	IS 16444 Part 1 with late amendments	A.C. Static Direct Connected Watt Hour Smart MeterClass 1 and 2- Specification
4	IS 15959 Part 1 & Part 2 latest amendments	Data Exchange for Electricity Meter Reading, Ta and Load Control-Companion Standards

Communication

Meter shall have the ability to communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1 (RF/PLCC /Cellular) in a secure manner. The selection of communication technology should be as per the site conditions and as per design consideration of AMI Implementing agency to meet the performance as per agreed Service Level Agreements (SLAs). In case of Cellular based

meter, the meter shall accommodate SIM card/ e-SIM of any service provider. In case of Plug-in type communication module, the meter shall log communication module removal /non-responsive event with snapshot.

Remote connect/disconnect/load limiting: Remote Connect/disconnect/Load control facilities would be as per IS 16444 part 1.

Other Specifications

Features	Minimum Requirement of Features
Applicable Standards	The meters shall comply with IS 16444 Part 1 for allrequirements.
Reference Voltage	As per relevant IS (240 V)
Current Rating	5-30 A 10-60 A
Category	UC1
Starting Current	As per IS 16444 Part 1
Accuracy	Class 1.0 as per IS 16444 Part 1
Limits of error	As per IS 16444 Part 1
Operating Temperature range	As per IS 13779
Humidity	As per IS 13779
Frequency	As per IS 16444 Part 1
Influence Quantities	As per IS 16444 Part 1
Power Consumption of meter	As per IS 16444 Part 1
Current and Voltage Circuit	As per IS 16444 Part 1
Running at No Load	As per IS 16444 Part 1
Test output device	As per IS 16444 Part 1
Meter Display	As per IS 16444 Part 1
Name Plate & marking Meter Display	As per IS 16444 Part 1
Parameters to be measured	As per IS 16444 Part 1 / As per IS 15959 Part-2
Maximum Demand resetting	As per IS 15959 Part 2
Time of Use registers	As per IS 15959 part 2
Power Quality Information	As per IS 15959 part 2
LED/LCD Indicators	As per IS 16444 Part 1
Load Survey/Interval Data	As per IS 15959 part 2
Tamper/ Event Recording	As per IS 15959 part 2
Measuring Elements	As per IS 16444 part 1

Features	Minimum Requirement of Features
Alarm	As per IS 16444 Part 1/ 15959 Part 2
Load Control	As per IS 16444 Part 1
Connect/Disconnect switch	UC1 (As per IS 16444 part 1)
Status of load switch	As per IS 16444 Part 1
Programmability	As per IS 16444 Part 1
Communication	As per IS 16444 Part 1
Data Exchange Protocol	As per IS 16444 Part 1
Remote Firmware upgrade	As per IS 15959 Part 2
Real Time Clock (RTC)	As per IS 16444 Part 1/ IS 15959 Part1 & Part 2
Data Retention	As per IS 16444 Part 1
Battery Backup	Meter shall be supplied with separate battery backup for RTC.
First Breath (power on) and Las gasp (power off) condition detec and communication to HES	As per IS 16444 Part 1
Plug-in Communication Module	The Smart Meters shall have a dedicated sealable slot for accommodating plug-in type bi -directional communication module which shall integrate the respective communication technology (RF/PLCC/ Cellular) with the Smart Meters, leading to easy adaptability for network interfaces (WAN/NAN). The Plug-In module shall be field swappable/ replaceable.

Data display facility (auto/manual)

As per IS 16444. However minimum requirement should include the following:

Data Display shall be in two modes-

- Auto Scroll
- Scroll with Push Button
- The display parameters shall be:
- Auto Scroll
  - Display Check
  - Date and Time
  - Last Recharge Amount
  - Last Recharge Time
  - Current Balance Amount
  - Current Balance Time
  - Cumulative Active Energy kWh with legend.
  - Current calendar month MD in kW with legend.
  - Instantaneous voltage

- Instantaneous Phase current
- Instantaneous Load kW
- Instantaneous average Power Factor

These parameters should be displayed on the Meter Display continuously for a period of 10 seconds on Auto scroll.

- Scroll with Push-button

  All Parameters mentioned under Auto-Scroll mode should be displayed. Additionally, the following Parameters shall also be displayed:

- Internal diagnostics (display check)
- Meter Serial No.
- Cumulative Energy in kVArh Lag/ Lead with legend
- Cumulative Active Energy kWh ToD wise with legends.
- Cumulative Apparent Energy kVAh ToD wise with legends.
- Current month MD in kVAh with legends
- Last month cumulative kWh with legends
- Last month cumulative kVAh with legends
- Last month MD in kW with legends
- Last month Average Power Factor
- Current month Average Power Factor

Further, the Meter should display high resolution energy values with resolution of 3 digits before decimal and 2 digits after decimal in push button mode
The meter's display should return to default display mode (continues auto scroll) if push button is not operated for more than 10 seconds. (The order of display may be revised as per requirement of the utility). Meter display should not go into sleep mode during Power-On condition.

Anti-tamper features

The meter shall continue recording energy under tamper conditions as defined in IS 15959 Part 2 and would log the event and send alarm at Head End System after detection of the defined tamper features as per IS 15959 Part 2.

Type Tests & Test Certificates

Smart Meter shall be type tested for all the tests as per relevant parts of IS 16444 (latest versions) and certified by Indian Standard wise list of BIS recognized labs as available at https://bis.gov.in/index.php/laboratorys/list-of-bis-recognized-lab/. The number of sampling for testing of meters and criteria for conformity would be as per IS 16444 (as amended up to date). Necessary copies of test certificates shall be submitted as per agreement with the utility.

Routine & Acceptance Tests

The Factory Acceptance and Routine tests shall be carried out as per IS 16444 Part 1.

General & Constructional requirements

Meter shall be BIS marked as per IS 16444 Part 1. General & construction requirement shall be as per IS 16444/IS 13779

Meter base & cover - Meter base & cover shall be as per IS 16444 Part1 / IS 13779. The meter Base & cover shall be 'Break to open' design. The material for meter base and cover shall be made of high-grade polycarbonate.

The meter Base & cover shall be ultrasonically welded / Chemically welded or other suitable bonding technology and it will not be possible to remove the cover from the base without evidence of damage

Terminal block & cover - As per IS 16444 Part 1/IS 13779

Design

Voltage circuit, sealing arrangement, terminal block, terminal cover, and nameplate etc. shall be in accordance with IS-16444 Part 1(latest version).
The meter shall be compact and reliable in design, easy to transport and immune to vibration and shock involved in transportation and handling.

Name plate and marking

The name plate on the meter should be clearly visible, effectively secured against removal and indelibly/distinctly marked in accordance with relevant IS. In addition, "Name of the Utility", purchase order no. & year/month of manufacturing shall be provided on the name plate. The rating plate information shall be as per relevant IS.
Connection diagram: As per IS 16444 Part 1

Fixing arrangements

The meter shall be mounted type. The Meter should have three fixing holes, one at top and two at the bottom. The Top hole should be such that the holding screw is not accessible to the consumer after fixing the meters. The lower screws should be provided under sealable terminal cover.

Sealing arrangement:

Arrangements shall be provided for proper sealing of the meter cover so that access to the working parts shall not be possible without breaking the seal. The sealing arrangement and number of seals shall be as per relevant IS/ requirement of utility.

Meter box:

The Meter Box if required by utility/purchaser, would be provided as per requirement of the utility/ purchaser and the material of the Meter Box should be such that it does not hamper communications.

Packing

The meters shall be suitably packed for vertical/horizontal support to withstand handling during transportation. The meter shall be packed appropriately to ensure safe transportation, handling, identification, and storage. All packing materials shall be as per environment law in force. The primary packing shall ensure protection against humidity, dust, grease and safeguard the meter's performance until its installation. The secondary packing shall provide protection during transportation. The packing case

shall indicate "Fragile in nature" and direction of placement of box. The packing shall indicate marking details like Manufacturer's name, S. No. of meters, quantity etc.

Transportation

- The meter shall be compact in design. The meter block unit shall be capable of withstandingstresses likely to occur in actual service and rough handling during transportation.
- The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.
- The meter should not be exposed to undue shock and mishandling during transportation.
- The stacking of box inside transport media should be such as to avoid their free movement.
- The packing should also be protected from rain and dust by transport media.
- The AMISP shall be responsible for any damage during transit due to inadequate or improper packing.

Testing and Manufacturing Facilities at Manufacturer's Place

The manufacturer shall have facilities of conducting Acceptance Testing as per IS 16444 Part 1.

Inspection

- The meters shall be sealed as per the mutual agreement of the supplier and the purchaser
- The utility/ purchaser may inspect the meter randomly as per sampling plan for acceptance test as per IS 16444 Part 1. The meters shall be tested for acceptance test as per IS 16444 Part 1

S.No	Description	Units	As Furnished by Bidder
1	Type of meter		
2	Accuracy Class of the meter		
3	Ib & Imax	A	
4	a. Operating Voltage for meter b. Operating Voltage with communication unit functionality	V	
5	Operating Frequency	Hz	
6	Power Consumption and Burden		
7	Starting Current	mA	
8	Short time over current	A	
9	Influence of heating		
10	Rated impulse withstand voltage	KV	
11	AC withstand Voltage for 1 min	KV	

12	Insulation resistance a) Between frame &Current, voltage circuits connectedtogether: b) Between each current (or voltage circuit) & each and every other circuit.	M ohm	
13	Mechanical requirement as per IS 13779		
14	Resistance to heat and fire (As per specification)		
15	Degree of protection		
16	Resistance against climatic influence (as per IS 13779) - Storage temperature - 25 to 70 Deg as per IS 13779, 2020 (-Operating temperate -10 to 55 Deg as per IS 13779, 2000 (outdoor) Meter OEM to produce data sheet of components, if so required during detailed engineering, from component manufacturers indicating temperature range.		
17	Electromagnetic Compatibility (EMC)		
18	Accuracy requirements (As per IS 13779		
19	Power factor range		
20	Energy measurement		
21	Connection Diagram for system on terminal cover	Yes/No	
22	Self-diagnostic feature		
23	Initial startup of meter (meter shall be fully functional within 5 sec after reference voltage is applied to the meter terminals)		
24	Terminal block		
	a)Depth of the Terminal holes	mm	
	b) Internal diameter of terminal holes	mm	
	c) Clearance between adjacent terminals	mm	
25	Communication capabilities as per clause 1.4.36		
26	Immunity against abnormal Magnetic influence, as defined in Clause 1.4.37		
27	Immunity against ESD as defined in clause 1.4.37		
28	DC Immunity as defined in clause 1.4.38		
29	Abnormal and tamper Conditions as per Table 4 - Tamper Event Details for Single Phase Smart Meters	Yes/No	

30	Grade of material for a) Meter base b) Meter cover c) Terminal block d) Terminal cover		
31	Tamper counts		
32	Recording forward energy in all conditions as per Annexure - 1 (including current/potential reversal)	Yes/No	
33	Makes of all components used in the meter to be provided	Yes/No	
34	Non-Volatile memory (Retention period)		
35	Measuring elements used in the meter		
36	Power supply to circuit in case of supply failure		
37	Display of measured values	Yes/No	
38	LCD display (Type and viewing angle)		
39	Pulse rate	Imp/ kWh,	
40	Name plate marking	Yes/No	
41	Routine test certificates	Yes/No	
42	Acceptance test certificates	Yes/No	
43	Type test certificates	Yes/No	
44	Guarantee certificates	Yes/No	
45	Output Device (LEDs) As per clause Error! Reference source	Yes/No	
46	Make of Disconnector switch		
47	Disconnector Technical particular as per Specification clause 1.4.35	Yes/No	
48	Terminal Screw dia.		
49	Allen Screw head size (Terminal Screw)		
50	Fire retardant category of the material a. Meter body b. Terminal block		

Annexure A2

Technical Specifications for Whole Current A.C. Three Phase Smart Energy Meter

Scope

The specification covers the design, manufacturing, testing, supply, and delivery of AC whole current 3 phase 4 wires Smart Energy Meter with bidirectional communication facility suitable for Advanced Metering Infrastructure (AMI) with connect/disconnect switch. The meter shall communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1, as per the requirement of the utility / authorized system integrator.

Basic Features

The Smart Meter would have the following minimum basic features-

- Measurement of electrical energy parameters
- Bidirectional Communication
- Integrated Load limiting switch /relay
- Tamper event detection, recording and reporting
- Power event alarms as per IS 16444 Part 1
- Remote firmware upgrade
- Pre-Paid features at MDM end (as per 15959 part 2)
- TOD feature
- Net Metering(kWh) features (optional as per requirement of utility)
- On demand reading

General standards applicable for meters

S. N	Standard No.	Title
1	IS 13779 with latest amendments	AC Static Watt-hour Meter class 1& 2
2	IS 15884 with latest amendments	Alternating Current Direct Connected Static Prepayment Meters for Active Energy (Class 1 and 2)- Specification
3	IS 16444 Part 1 with latest amendments	A.C. Static Direct Connected Watt Hour Smart Meter Class 1 and 2- Specification
4	IS 15959 Part 1 & Part 2 with latest amendments	Data Exchange for Electricity Meter Reading, Tariff and Load Control-Companion Standards

Communication

Meter shall have the ability to communicate with Head End System (HES) on any one of the communication technologies mentioned in IS16444 Part 1 (RF/PLC/ Cellular) in a secure manner. The selection of communication technology should be as per the site conditions and as per design requirement of AMI Implementing agency to meet the performance as per agreed Service Level Agreements (SLAs). In case of Cellular based meter, the meter shall accommodate SIM card/ e-SIM of any service provider. The meter

shall log the removal of the plug-in type communication module removal /nonresponsive event with snapshot.

Remote connect/disconnect/load limiting: Remote Connect/disconnect/Load control facilities would be as per IS 16444 part 1.

Other Specifications

Features	Minimum requirement of features
Applicable Standards	The meters shall comply with IS 16444 Part 1 for all requirements.
Reference Voltage	As per relevant IS
Current Rating	10-60 A / 20-100 A
Category	UC1
Starting Current	As per IS 16444 Part 1
Accuracy	Class 1.0 as per IS 16444 Part 1
Limits of error	As per IS 16444 Part 1
Operating Temperature range	As per IS 13779
Humidity	As per IS 13779
Frequency	As per IS 16444 Part 1
Influence Quantities	As per IS 16444 Part 1
Power Consumption of meter	As per IS 16444 Part 1
Current and Voltage Circuit	As per IS 16444 Part 1
Running at No Load	As per IS 16444 Part 1
Test output device	As per IS 16444 Part 1
Meter Display	As per IS 16444 Part 1
Name Plate & marking Meter Display	As per IS 16444 Part 1
Parameters to be measured	As per IS 16444 Part 1 / As per IS 15959 Part-2
Maximum Demand resetting	As per IS 15959 Part-2
Time of Use registers	As per IS 15959 Part-2
Power Quality Information	As per IS 15959 Part-2
LED/LCD Indicators	As per IS 16444 Part 1
Load Survey/Interval Data	As per IS 15959 Part-2
Tamper/ Event Recording	As per IS 15959 Part-2
Measuring Elements	As per Is 16444 Part 1
Alarm	As per IS 16444 Part 1 / As per IS 15959 Part-2
Load Control	As per IS 16444 Part 1
Connect/Disconnect switch	UC1 as per IS 16444 Part 1
Status of Load switch	As per IS 16444 Part 1
Programmability	As per IS 16444 Part 1

Communication	As per IS 16444 Part 1
Communication Protocol	As per IS 16444 Part 1
Remote Firmware upgrade	As per IS 15959 Part-2
Real Time Clock (RTC)	As per IS 16444 Part 1 / IS 15959 Part 1 & Part 2
Data Retention	As per IS 16444 Part 1
Battery Backup	Meter shall be supplied with adequate separate batte backup for RTC.
First Breath (Power on) and L gasp (Power off) condition detection and communicatior HES	As per IS 16444 Part 1
Plug-in Communication Mod	The Smart Meters shall have a dedicated sealable slot for accommodating plug-in type bi -directional communication module which shall integrate the respective communication technology (RF/PLC/ Cellular) with the Smart Meters, leading to easy adaptability for network interfaces (WAN/NAN).The Plug-In module shall be field swappable/ replaceable.

Data display facility (auto/manual)

As per IS 16444. However minimum requirement should include the following: Data Display shall be in two modes-

1. Auto Scroll
2. Scroll with Push Button

The display parameters shall be:

- Auto Scroll
- Display Check
- Date and Time
- Last Recharge Amount
- Last Recharge Time
- Current Balance Amount
- Current Balance time
- Cumulative Active Energy kWh with legend.
- Cumulative Apparent Energy kVAh with legend.
- Current month MD in kW with legend.
- Current month average Power Factor
- Instantaneous voltage V_{RN}
- Instantaneous voltage V_{YN}
- Instantaneous voltage V_{BN}
- Instantaneous current I_R
- Instantaneous current I_Y
- Instantaneous current I_B
- Instantaneous current I_N
- Instantaneous Load kW and kVA
- Instantaneous average Power Factor

These parameters should be displayed on the LCD/LED continuously for a period of 10 seconds on Auto scroll.

- Scroll with Push-button

All Parameters mentioned under Auto-Scroll mode should be displayed. Additionally, the followingParameters shall also be displayed:

- Internal diagnostics (display check)
- Meter Serial No
- Cumulative Energy in kVArh Lag/ Lead with legend
- Cumulative Active Energy kWh ToD wise with legends.
- Cumulative Apparent Energy kVAh ToD wise with legends.
- Current month MD in kVA with legends
- Last month cumulative kWh with legends
- Last month cumulative kVAh with legends
- Last month MD in kW with legends
- Last month Average Power Factor

Further, the Meter should display High Resolution energy values with resolution of 3 digits before decimal and 2 digits after decimal in push button mode.

The meter's display should return to default display mode (continues auto scroll) if push button is notoperated for more than 10 seconds. (The order of display may be as per the requirement of utility). Meter display should not go in to sleep mode during Power-On condition.

Anti-tamper features

The meter shall continue working under tamper conditions as defined in IS 15959 Part 2 and would log the event and send alarm at Head End System after detection of the defined tamper features as per IS 15959 Part 2.

Type Tests & Test Certificates

Smart Meter shall be type tested for tests as per relevant parts of IS 16444 (latest versions) and certified by Indian Standard wise list of BIS recognized labs as available at https://bis.gov.in/index.php/laboratorys/list-of-bis-recognized-lab/. The number of sampling for testing of meters and criteria for conformity would be as per IS 16444(as amended up to date). Necessary copies of test certificates shall be submitted as per agreement with the utility.

Routine & Acceptance Tests

The Factory Acceptance and Routine tests shall be carried out as per IS 16444 Part 1.

General & Constructional requirements

Meter shall be BIS marked as per IS 16444 Part 1. General & construction requirement shall be as per IS 16444/IS 13779

Meter base & cover - Meter base & cover shall be as per IS 16444 Part1 / IS 13779. The meter Base & cover shall be 'Break to open' design. The material for meter base and cover shall be made of high-grade polycarbonate.
The meter Base & cover shall be ultrasonically welded / Chemically welded or other suitable bonding technology and it will not be possible to remove the cover from the base without evidence of damage

Terminal block & cover - As per IS 16444 Part 1/IS 13779

Design

Voltage circuit, sealing arrangement, terminal block, terminal cover and nameplate etc. shall be in accordance with IS-16444 Part 1 (latest version). The meter shall be compact and reliable in design, easy to transport and immune to vibration and shock involved in transportation and handling

Name plate and marking

The meter should bear a name plate clearly visible, effectively secured against removal and indelibly/distinctly marked in accordance with relevant IS. In addition, "Name of the Utility", purchase order no. & year/month of manufacturing shall be provided on the meter name plate. The rating plate information shall be as per relevant IS.

Connection diagram: As per IS 16444 Part 1

Fixing arrangements:

The meter shall be mounted type. The Meter should have three fixing holes, one at top and two at the bottom. The Top hole should be such that the holding screw is not accessible to the consumer after fixing the meters. The lower screws should be provided under sealable terminal cover. The requisite fixing screws shall be supplied with each meter.

Sealing arrangement:

Arrangements shall be provided for proper sealing of the meter cover so that access to the working parts shall not be possible without breaking the seal. The sealing arrangement and number of seals shall be as per relevant IS/ requirement of utility.

Meter box:

The Meter Box if required, would be provided as per requirement of the utility/ purchaser and the material of the Meter Box should be such that it does not hamper communications.

Packing

- The meters shall be suitably packed for vertical/horizontal support to withstand handling during transportation.
- The meter shall be packed appropriately to ensure safe transportation, handling, identification and storage.
- All packing materials shall be as per environment law in force. The primary packing shall ensure protection against humidity, dust, grease and safeguard the meter's performance until its installation.

- The secondary packing shall provide protection during transportation.
- The packing case shall indicate “Fragile in nature” and direction of placement of box.
- The packing shall indicate marking details like Manufacturer’s name, meters #s, quantity, etc.

Transportation

- The meter shall be compact in design. The meter block unit shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation.
- The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.
- The meter should not be exposed to undue shock and mishandling during transportation.
- The stacking of box inside transport media should be such as to avoid their free movement.
- The packing should also be protected from rain and dust by transport media.
- The AMISP shall be responsible for any damage during transit due to inadequate or improper packing.

Testing and Manufacturing Facilities at Manufacturer’s Place

The manufacturer shall have facilities of conducting Acceptance Testing as per IS 16444 Part 1.

Inspection

- The meters shall be sealed as per the mutual agreement of the supplier and the purchaser
- The Utility/ purchaser may inspect the meter randomly as per sampling plan for acceptance test as per IS 16444 Part 1. The meters shall be tested for acceptance test as per IS 16444 Part 1

Annexure A3

Three phase CT operated alternating current Smart Meter of Accuracy Class 0.5S (DT Meter, LT-CT Meter, etc.)

General Standards Applicable for Meter

Unless otherwise specified elsewhere in this specification, the performance and testing of the meters shall conform to the following standards and amendments/revisions thereof.

Sl. No	Standard No.	Title
1	IS 16444: Part 2 with latest amendments	AC Static Transformer Operated Watt-hourand VAR-Hour Smart Meters, class 0.2S, 0.5S and 1S
2	CBIP- Publication 325 with latest amendments	Standardization of AC Static Electrical Energy Meters
3	CBIP Technical report no. 111 with latest amendments	Specification for Common Meter ReadingInstrument
4	IS:9000 with latest amendments	Basic Environmental Testing Proceduresfor Electronic & Electrical Items.
5	IS 12063 with latest amendments	Degrees of protection provided by enclosures of electrical equipment.
6	IS 14451, Part-2: 1999 with latest amendments	Telemetering for consumption and demand. Direct digital transfer of metervalues.
7	IS 4905: 1999 with latest amendments	Methods for Random sampling.
8	IS 12346 with latest amendments	Specifications for Testing Equipment forAC Energy meter.
9	IS 15959 Part 3 (as applicable) with latest amendments	Data exchange for electricity meter reading, tariff and load control: Companion specification

Communication

Meter shall have ability to communicate with HES on any one of the technologies mentioned in IS 16444 (RF/Cellular/PLC) in a secure manner. The selection of communication technology should be as per the site conditions and as per design requirement of the AMISP to meet the Service Level Agreements (SLAs). In case of cellular based meter, the meter shall accommodate dual SIM Card / e-SIM of any service provider. The meter shall log the removal of the plug-in type communication module removal /nonresponsive event with snapshot.

Other Specifications

Particulars	Specifications
Applicable Standards	The meters shall comply with IS 16444: Part2 for all requirements except for those parameters which have been specifically mentioned to be otherwise in this specification.
Reference Voltage	[As per relevant IS]
Current Rating	Ib 5A
Starting Current	As per IS 16444: Part2
Accuracy	Class 0.5S as per IS 16444: Part 2
Limits of error	As per IS 16444: Part 2
Operating Temperature range	As per IS 16444: Part 2
Humidity	As per IS 16444: Part 2
Frequency	As per IS 16444: Part 2
Influence Quantities	As per IS 16444: Part 2
Power Consumption of meter excluding communication module	As per IS 16444: Part 2
Current and Voltage circuit	As per IS 16444: Part 2
Running at No Load	As per IS 16444: Part 2
Test output device	As per IS 16444: Part 2
Meter Display	As per IS 16444: Part 2
Time of Use (In case of net-meter both export & import parameters to be measured)	As per IS 15959: Part 3 (as applicable)
Parameters to be measured	As per IS 16444: Part 2 / IS 15959: Part 3 (as applicable)
Power Quality Information	As per IS 15959: Part 3 (as applicable)
Maximum Demand	As per IS 15959: Part 3 (as applicable)
Load Survey/Interval Data	As per IS 15959: Part 3 (as applicable)
LED/LCD Indicators	As per IS 16444: Part 2
Tamper/Event recording	As per IS 15959: Part 3 (as applicable)
Alarm	As per IS 16444 / IS 15959: Part 3 (as applicable)
Measuring Elements	As per IS 16444: Part 2
	The meter shall continue working under tamper conditions as defined in IS 15959 Part 3 and would

Anti-Tamper features	log the event and send alarm at HES after logging of the defined tamper features as per IS 15959 Part 3.
Programmability	As per IS 16444: Part 2
Communication	As per IS 16444: Part 2
Communication Protocol	As per IS 15959: Part 3 (as applicable)
Real time clock (RTC)	As per IS 16444: Part 2 / IS 15959: Part 3 (as applicable)
Data Retention	As per IS 16444: Part 2
Battery Backup	Meter shall be supplied with separate battery backup for RTC.
Data display facility (manual/Auto)	As per IS 16444: Part 2 (as applicable) However minimum requirement should include the following: Data Display shall have following features: • High Resolution (Shall display energy values with resolution of 2 digits before decimal and 3 digits after decimal. • The Push button for manual scrolling in addition to auto scrolling with a persistence time of 10 seconds for each parameter shall be provided. Display of data as per IS 16444 (Part 2)
Remote Firmware Upgrade	As per IS 15959: Part 3 (as applicable)
Digital Input (DI)	The Smart meter should have the provision of sensing digital inputs via DI (Digital Input) port provided at the terminal block. The smart meter should register the digital input(s) sensed, upon reaching respective threshold (configurable) and the event shall be communicated to HES. The OBIS code required for this shall be provided during detailed engineering. The requisite power supply requirement (AC to DC auxiliary supply/ charger) for the DI should be made internal to the smart meter itself. In case the same is not feasible to be provided, bidder should provide external power supply with following specifications. d) Input voltage: 63.5V AC e) Operating voltage: 12V DC f) Contact Rating: 5A Continuous @30V DC, 25A for 3 sec No. of DIs - 04 Nos. DI for 4V(DC), 10 mA

Annexure A4

General requirement for common pluggable communication module for Smart Meters

Considering that the new Smart Meters may use different types of communication technologies (RF/Cellular, etc.), thus in order to enable different communication modules to be used in the same meter, it is necessary to use a universal interface and a particular size irrespective of the choice of communication technology that defines the dimensions of the communication slot as well as physical placement and location of connectors. The following example recommendations will go a long way in assuring interoperability whilst still complying with the provisions of IS 16444 and IS 15959 standards:

Part I

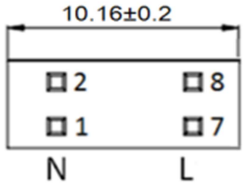
1. **Recommended Module Placement location**
   In order to improve the Radio Performances of any of the wireless technologies encompassing but not limited to Cellular, RF and / or RF mesh, it is recommended to place the communication module anywhere on the accessible part of the meter. This will also enable an easy approach to improve antennae performances.
2. Meter shall have the means of tamper detection to record the event(s) of the removal of the communication module set from the meter, irrespective of whether the meter is in power on (has supply) or powered off (no supply) condition.
3. The Module shall be hot swappable and shall fit snugly inside the meter box, so that the same IP class of the meter is maintained.
4. A transparent cover may be used for the purpose,

a. To have a sealing arrangement with the meter body as well as
b. For easy viewing of LED indicators and antenna assembly without having to open the cover

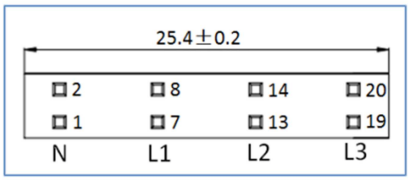
Part II

AC power interface:
In the event of PLC communication being chosen as the only or one of the choices, the following arrangement of connector and pinouts need to be provisioned on the communication module.

Female connector

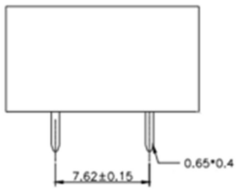


Single phase meter

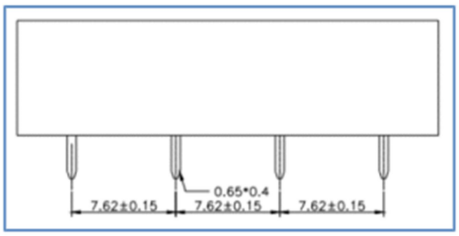


Poly phase meter

2、Top View:

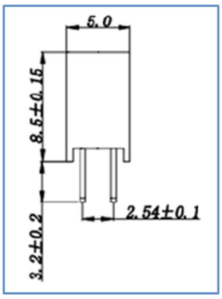


Single phase meter



Poly phase meter

3、Side View:

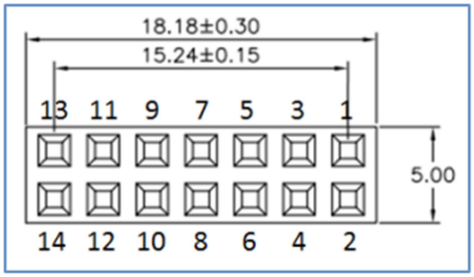


Pin to Pin distance should be: 7.62mm (Standard Pin connector)

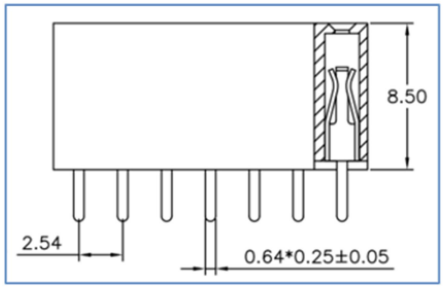
Communication interface:
The meter shall have a slot of an appropriate size to allow for the pluggable communication module (such as but not limited to NAN /WAN, dual mode RF, Dual Technology, cellular etc.) to be fit in to the meter. The meter shall provide a 14-pins Female socket connector (2*7pin, 2.54mm). The socket shall be selected and positioned to ensure that the male pins on the communication module can connect reliably and easily connect with the female contactors on the meter.

Female connector

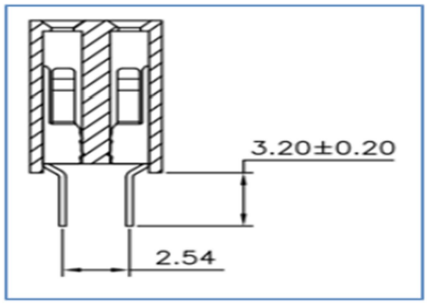
1. Front View :



2. Top View:



3. Side View:



PIN Outs may be provided as per below details

Pin N	Name	Input/output	Description
1	Reserved	/	/
2	Reserved	/	/
3	Power EN	Output	Control the module's power supply
4	Reserved	/	/
5	Reserved	/	/
6	Meter TXD	Output	To Module UART port RXD, Min.38400
7	Meter RXD	Input	From Module UART port TXD, Min.38400
8	Reserved	/	/
9	RTS	Input	Input digital signal from module
10	RST	Output	Reset signal for module
11	CTS	Output	Output digital signal to module

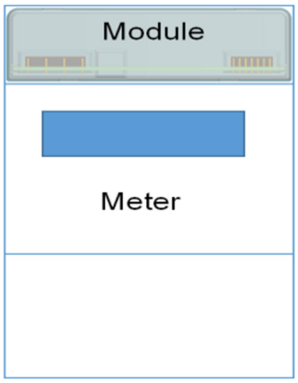
12	+Vdc	Power	As per IS16444
13	GND	Common	Ground Reference Potential
14	GND	Common	Ground Reference Potential

Part III

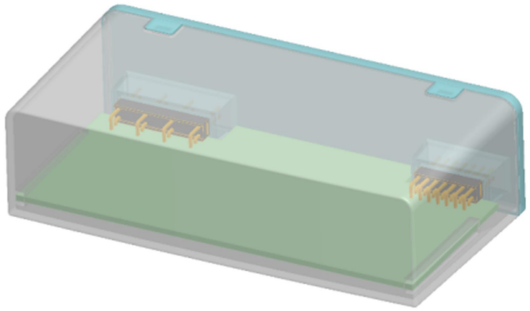
The following reference size may be adhered to irrespective of a single or multiple communication options provisioned on the same module. This standard form factor and dimensions will enable physical and functional interoperability with different makes of meters.

A. Module 3-D views (For Representational Purpose Only)

1. Module in meter (Top View)



2. 3D View



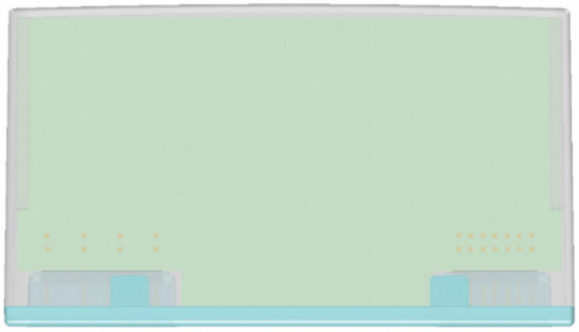
4. Back View

3. Front View

5. Side View

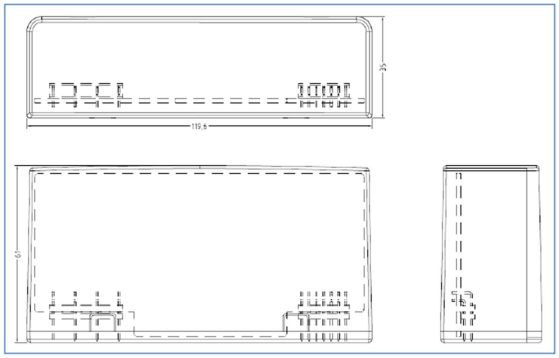
6. Top View

7. Bottom View

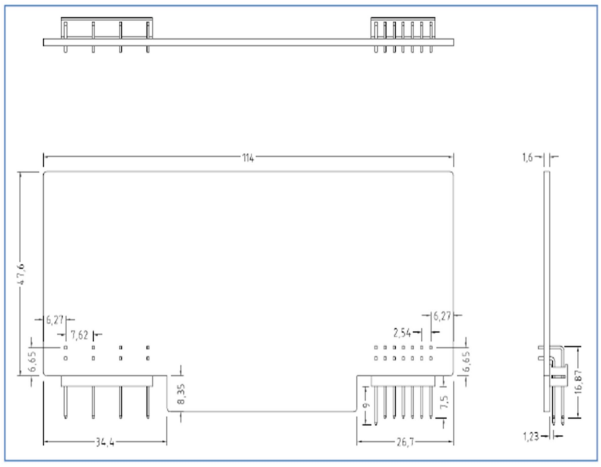


B. Module Dimensions

Overall view of the module:



Overall view of the module's PCBA:



Notes: Module Reference Sizes: unit mm.

Annexure A5
Specifications of CT for LT-CT meters

Technical Specification of Current Transformer

1. General:
This specification covers manufacture, test, & supply of LT Current transformers of class 0.5 accuracy.
The CTs shall be suitable for metering purpose.

2. Type:
The CTs shall be of ring type and bar type as per site requirement.

The secondary leads shall be terminated with Tinned Cooper rose contact terminals with arrangements for sealing purposes. Polarity (both for primary and second leads) shall be marked.

The CTs shall be varnished, fiberglass tape insulated or cast resin, air-cooled type. Only super enameled electrolytic grade copper wires shall be used.
The CTs shall conform to IS 2705:Part-I & II/IEC:185 with latest amendments.

2.1. TECHNICAL DETAILS:

Technical details shall be as given below:

1.	Class of Accuracy	0.5
2.	Rated Burden	5.00 VA
3.	Power Frequency Withstand Voltage	3KV
4.	Highest System Voltage	433 V
5.	Nominal System Voltage	400 V
6.	Frequency	50 Hz
7.	Supply System	3 Ph. Solidly grounded Neutral System

Transformation ratio shall be specified from the following standard ratings as per requirement:

S,No	LTCT Consumers/DT rating	CT Ratio
1	>10 kVA upto 30kVA	50/5
2	>30kVA upto 47kVA	75/5
3	>47kVA upto 63 kVA	100/5
4	>63 kVA upto 94 kVA	150/5
5	>94kVA upto 125kVA	200/5

6	>125kVA upto 187kVA	300/5
7	>187kVA upto 250kVA	400/5
8	>250kVA upto 310kVA	500/5
9	>310kVA upto 375kVA	600/5
10	>375kVA upto 575kVA	800/5
11	>575kVA upto 700kVA	1000/5

Bore diameter of the CT shall not be less than 40 mm. Ring type CTs shall have suitable clamp to fix the CT to panel Board, wherever required.

The limits of current error and phase angle displacement as per IS:2705 at several defined percentage of rated current are:

Accuracy Class	% Ratio error at % of r current				Phase displacement in minutes of rated current			
0.5	5	20	100	120	5	20	100	120
	1.5	0.75	0.5	0.5	90	45	30	30

Current error and phase displacement at rated frequency is required to be as above when the secondary burden from 25% to 100% of the rated burden i.e. 50 V A.
Rated extended primary current shall be 120% of rated primary Current in accordance with IS:2705 Pt-II.
Rated ISF (Instrument Security Factor) shall be declared by the manufacturer & marked on the CT.
CT's shall be made with good engineering practices. Core winding shall evenly spread stress & avoid stress concentration at any one point. Cast resin CT's shall be processed by hot curing method under controlled vacuum conditions.
The base shall be of hot dip galvanized steel.

2.2. TESTS

2.2.1. TYPE TESTS:

Copies of all type tests as per IS.2705 Part-I and II including short time current & temperature rise tests in NABL accredited laboratory shall be submitted and got approved before commencement of supply.

2.2.2. ROUTINE TESTS:

The supplier shall conduct all the routine tests such as Ratio test, phase angle error test for 0.5 accuracy class as per IS 2705 Part I & II.

2.2.3. COMMISSIONING TEST:

In accordance with IS:2705, Power frequency test on primary winding shall be carried out after erection on site on sample basis.

2.3. MARKING:

The CTs shall have marking and nameplate as per IS 2705 in addition to class of insulation & ISF. The markings shall be indelible. The nameplate shall be securely fixed to the body of the CT.

2.4. PACKING:

Each CT shall be securely packed to withstand rough handling during transit and storage.

2.5. QUALITY ASSURANCE PLAN:

Immediately on award of contract, the bidder shall prepare detailed quality assurance plan / test procedure identifying the various stages of manufacture, quality checks performed at each stage, raw material inspection and the Customer hold points. The document shall also furnish details of method of checking, inspection and acceptance standards / values and get the approval of Purchaser before proceeding with manufacturing. However, Purchaser shall have right to review the inspection reports, quality checks and results of suppliers in house inspection department which are not Customer hold points and the supplier shall comply with the remarks made by purchaser or his representative on such reviews with regards to further testing, rectification or rejection.

Purchaser reserve the right to send any material out of the supply to any recognized laboratory for testing and the cost of testing shall be borne by the Purchaser. In case the material is found not in order with the technical requirement / specification, the charges along with any other penalty which may be levied is to be borne by the bidder. To avoid any complaint the supplier is advised to send his representative to the stores to see that the material sent for testing is being sealed in the presence of bidder's representative.

Annexure A6

Specifications of 1-ph and 3-ph Polycarbonate Meter Box and 2:1 & 4:1 Meter Box for 1-ph Consumers

SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at store/site and performance of single phase meter box intended to contain one number single phase whole current energy meter complete with all accessories for trouble free and efficient operation.

APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest edition of the following Indian/international standards and shall conform to the regulations of the local statutory authorities.

S. No.	Standard Name	Title
i.	IS:14772-2000	General requirements for Meter boxes for accessories for household and similar fixed electrical installations- specifications.
ii.	IS:11731(Part-II)-1992	Methods of test for determination of Flammability of solid electrical insulating material when exposed to an igniting source.
iii.	IS:4249-1967	Specification for classification and method of test for non- ignitable and self-extinguishing properties of solid electrical insulating materials.
iv.	IS:5133(Part-II)-1969	Specification for boxes far the Meter box of electrical accessories.
v.	IS:2500(Part-I)- 2000	Sampling procedure for inspection by attributes part-I sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection.
vi.	UL 746-C	Polymeric Materials in Electrical equipment.

GENERAL TECHNICAL REQUIREMENTS PROPERTIES OF PLASTIC MATERIAL

The plastic material, which is to be used by the bidder for these molded Meter Box, must have the following properties:

S. No	Property	Units	Value
1.	Physical Water Absorption	%	Max. 0.35
2.	Thermal HDT	Deg. C	Min. 125.
3.	Flammability a) Rating b) Glow wire test @ 650 Deg. C		FV2 Passes

4.	Mechanical a) Tensile Strength b) Flexural strength c) Modulus of Elasticity d) Izod impact strength notched 23^{O}C.	Mpa Mpa Mpa KJ/Sq.m.	Min. 50 Min. 90 Min. 2000 Min 8

Technical Requirements

S. No.	Description	Requirement
i.	Application	Outdoor
ii.	Degree of protection	IP 55
iii.	Flammability requirement	FV2
iv.	Grade of material	Polycarbonate with fire retardant, Self-Extinguishing, UV stabilized and anti-oxidation properties having good dielectric and mechanical strength.
v.	Material	Meter box (base and Cover) shall be made of polycarbonate material which complies following properties; • Meter box shall be weather proof • Capable to withstanding temperatures of boiling water for 5 minutes continuously without distortion or softening. • It shall withstanding Glow-wire test at 650DC as per IS:14772.
	a) Base:	Polycarbonate with fire retardant, Self-Extinguishing, UV stabilized and anti-oxidation properties having good dielectric and mechanical strength.
	b) Cover:	Opaque. Polycarbonate with fire retardant, Self-Extinguishing, UV stabilized and anti-oxidation properties having good dielectric and mechanical strength. Transparent.
vi.	Material of the gasket	Rubber gasket
vii	Material withstand	125^{o}C $\pm$ 2 ^{o}C

GENERAL CONSTRUCTIONS:

i. The meter box shall be weatherproof, tamper proof and shall be made of Injection moulded polycarbonate material with self-extinguishing, UV stabilized, recyclable and Anti oxidation properties having good dielectric and mechanical strength. The box shall be of adequate strength, unbreakable and shall be made in two pieces (base and cover). The base shall be opaque whereas the cover shall be completely transparent.

ii. The meter Box shall have roof tapering down to both the sides for easy flow of rainwater and shall have IP 55 degree of protection for affording protection against dust and water.

iii. The thickness of the box shall not be less than 3.0 mm on the load bearing side and other sides, door and roof shall not be less than 2.5 mm.

iv. The box shall be designed in such a way that there should be the following clearances between the meter and the Meter box:

S. No.	Parameter	Minimum Clearance
i.	Between Sides of the meter body and meter box (Excluding the flanges on the meter body for sealing screws.)	30 mm
ii.	Between the lower edge of the terminal block and the box	70 mm
iii.	Between the back of the meter and the meter box base	10 mm
iv.	Between the front of the meter and the meter box front	10 mm
v.	Between the top of the meter and the meter box cover	20 mm

v. The meter base supports inside the box should have adequate strong enough moulded supports within the block to avoid damage during tightening of screws and raised by about 10 mm in the box for ease of wiring. While fixing, the meter screws should not protrude outside.

vi. The design of the meter box shall be such that it may facilitate easy wiring and access to the meter terminals. Suitable circular holes shall be provided at the bottom of the cupboard for inlet & outlet cables with glands of size 15/16mm suitable for 2 core armoured aluminium cable(s) and for three phase meter, for internal gland diameter shall be 22-26 mm made of engineering plastic for the cable securely fixed to the bottom of the meter box on both sides by chuck-nuts. A suitable arrangement like clamping nut may be provided with the gland so that opening diameter can be reduced to the size of cable.

vii. The box cover shall be fixed to the base through two number hinges (approx. length 30 - 60 mm). The arrangement for hinges shall be provided on the side of the base and shall be such that it may avoid unauthorized access to inside of the box. Hinges should be outside and enclosed by polycarbonate material and once the box is closed and sealed, hinges should not be approachable. Box cover shall be openable by more than 90 degrees.

viii. For holding and sealing the box, two U-shaped latches shall be provided. The latch shall be Gl sheet with minimum thickness 2 mm, to secure it with the base of the box. The latch shall be provided along with suitable clamp assembly in base as well as cover, such that these are fully covered by the latch after closing. The clamp along with

the latch shall have a sealing hole such as to provide a through sealing arrangement in the assembly.

ix. For fixing the box to flat wall or wooden board 4Nos. holes (2Nos. key holes at top) of minimum 6 mm dia. shall be provided at the four corners of the meter box. For fixing of Box on flat wall, 4 Nos. 5mm diameter 40mm long, pan head self- taping screws and washers shall be provided by the supplier with every Box. 4 Nos. plastic fixing plugs of 50mm length suitable for self-tapping screws shall also be provided.

x. The meter is to be installed in the Meter Box and the Meter Box in assembled condition shall have provision to fix it to a pole or on wall.

xi. A provision in form of depression should be provided on the meter box cover to download the meter data from the meter using the CMRI probe without opening the meter box cover. This shall be provided in such a way that the optical probe of the CMRI cable can be placed on top of the meter box cover in a suitable depression in the meter box cover, which is aligned suitably with the meter optical port. The meter box cover shall have provision of sealing this depression. The depression so provided should be covered so that there is no physical access to the meter optical port while using this depression.

xii. Suitable rubber gasket of round shape all around the cover along its periphery shall be provided for protection.

xiii. After closing and sealing the meter box, it should not be possible to allow entry of any sharp object even forcefully inside the box without breaking base/cover.

xiv. Suitable overlapping (approx. 10 mm) shall be provided between base and cover to avoid access to the meter or its accessories inside the meter box by any means after sealing the box.

xv. The tolerance permissible in overall dimension of Meter Box shall be ± 2 %.

Meter Body Material: Base body and top cover shall be made of UV stabilized, unbreakable high grade flame retardant insulating material of good dielectric and mechanical strength with FV2/V2 in-flammability level.

Terminal Block:

a) The terminal block shall be moulded type made of non-hygroscopic, flame-retardant material having good dielectric and mechanical strength.
b) The moulded terminal block shall be made from best quality phenol formaldehyde/Poly carbonate conforming to IS:13779-1999 (latest amended) having adequate insulating properties and mechanical strength with brass inserts for connecting terminals.
c) The terminal block should satisfy all the conditions specified in IS:13779 and IEC 62052 -

11. The material of the terminal block should fulfil the requirement of following tests:

- The flame retardant rating of V0 as per UL 94 testing.
- The glow wire test for temperature of 960OC. as per IS:11000 (Part 2/Sec.1) or IEC 60695-2-1.

- Heat deflection temperature (HDT) test of 135OC. as per ISO 75 or ASTM D-648
- Ball pressure test at 125OC. as per IEC 60335-1.

2:1 & 4:1 Meter Box arrangement for 1-ph Consumers:

The bidder shall provide the design specification for the arrangement of 1:1 Meter box for 1-ph Consumers in Polycarbonate meeting the quality requirements as mentioned in the specification for Polycarbonate boxes.

Annexure A7
Specifications of LTCT Meter Box

Scope:

- This specification covers the design, manufacture, testing and supply of anti-corrosive, dust proof, rust proof, shock proof, vermin and water proof, U.V. stabilized and pilfer resistant meter boxes made of Glass reinforced, polyester sheet moulding compound (SMC) confirming to IS:13410:1992 (with latest amendment thereof) for installation on distribution transformers of various ratings.

- Meter boxes shall consist of two separate chambers, one suitable to accommodate LT TVM and other suitable for installation of 4 nos. single core, single ratio, ring type Current Transformers (CTs) of current ratios as per requirement in the RfP.

Constructional Features of Meter Box:

- LTCT SMC Box: Meter Box shall be made of minimum 2.5 mm. thick Glass reinforced Polyester sheet moulding compound (SMC) conforming to IS:13410:1992 with latest amendments thereof.

- LT meter box shall contain two separate chambers. The upper chamber shall be suitable to house 3 phase 4 wire energy meter. The lower chamber of the box is intended for housing 04 nos. ring type LT CTs. Both the chambers of box shall be independent from each other.

- The appropriate size of cables from the secondary of distribution transformer shall pass through ring type LT CTs.

- If any portion of box is closed, it shall not be possible to approach it by opening the other portion and vice-versa. It shall be moulded in a single piece forming the body of the Meter Box and CT chamber with SMC lid/shed fitted with the base by two nos. concealed brass hinges.

- The concealed brass hinges shall be fitted with the meter Box body base and the cover rigidly in such a way that the same are neither visible nor accessible from outside, thereby making the Meter Box pilfer proof.

- The door/cover in closed position should house properly within collar of meter box/ body base, which shall also house the edges of the lid/cover so that no direct entry or access is possible. The box should have a front door opening with a window provided with toughened glass of minimum 4.0 mm. thickness for viewing and taking meter reading.

- The meter box shall be of moulded type without any fabrication joint made by the process of hot press compression moulding.

- The body of the Meter Box shall have such construction that while installing on the grouted bolts of base-wall/ mounting bracket, the top surfaces of the box shall have little tapering shape frame centre towards both sides of the meter box so that easy flow of rainwater etc. is facilitated.

- The meter box should be anti-corrosive, rust-proof, dust-proof, vermin-proof, water-proof, UN, stabilized and pilfer resistant. The meter box becomes completely closed by providing locking arrangement in the shape of two nos. clamps.
- Clamp shall have separate holes of 1 mm. dia. each across the meter box body base as well as covers for both the chambers separately
- The meter box shall have four wall mounting bracket with proper screws to fix with the bottom base and provision for Four nos. holes each of 6 mm. dia.
- The meter box should neither melt nor become soft or distort when tested up to temperatures 2500C. (As per IS 13360 part 6 sec 10 1992 by 'A' capillary tube method The thickness of these boxes shall not be less than 2.5 mm on all sides including floor. The box shall have 3 mm thickness on the tongue and groove area. The meter box cover shall have a groove to hold minimum of 2.5 mm Neoprene gasket.
- The tongue of the base shall ensure tongue, Groove and sealing arrangement against rainwater and dust entering inside the box. The box shall have its roof tapering down to both sides for easy flow of water.
- The boxes shall generally comply with the provision of IS: 14772:2000. The boxes shall be suitable for outdoor / indoor application. The box shall be with good workmanship. There should be a minimum of 25 mm clearance on all sides and 25 mm clearance on the front and 10 mm clearance on the back of the meter.
- Sufficient space should be available inside the meter box for making out-going connections of the leads with the terminal block of the meter.

Material Of Meter Box:

- LTCT SMC Box: Material for construction of meter box shall be glass reinforced polyester sheet moulding compound (SMC) as per IS: 13410:1992 Grade S-1 with latest amendment thereof. Thickness of boxes shall be 2.5 mm from all sides. However, thickness of partition plate shall be 2.0 mm.
- LTCT Polycarbonate boxes: The meter box shall be weather proof, tamper proof and shall be made of Injection moulded reinforce polycarbonate material with FV0 fire retardant, self-extinguishing, UV stabilization and Anti oxidation properties. The box shall be of adequate strength , unbreakable and shall be made in two pieces(base and cover). The base shall be dark grey color whereas the cover shall be completely transparent for polycarbonate material .The material for base and cover shall be polycarbonate with minimum cover thickens of 2.5mm & base -3 mm thickness.
- The material of meter box should be anti-corrosive, rust proof, waterproof, shock proof and U.V stabilized.
- Material of meter box should not get soften on heating. (Heat distortion temperature should be above 1702 C.)

- The material of Meter box should be self-extinguishing as per IS: 4249 with latest amendment thereof.
- All MS parts of the meter boxes shall be anti-corrosive treated.

Rating Plate: Manufacturers should Screen Print the following information on each meter box.

- Name of Manufacturer
- Year of manufacturing
- Type of Meter
- PO NO with Date
- Meter Box Number
- Property of Utility

The same shall be finalized during GTP approval stage.

Annexure A8

Specification of Polycarbonate Seals.

Specification of Poly Carbonate Seals required for Sealing of Single / Poly Phase Meters

<table>
<tr><td>1</td><td>SCOPE</td><td>The specification covers the design, manufacture, testing at manufacturers works, supply and delivery at destination stores of tamper evident poly-carbonate security seals (Anchor type) heat resistant for sealing of Meter body and terminal covers of energy meters, Meter Box, CT-PT Units etc. with non-corrosive, non-magnetic stainless steel sealing wire.
It is not the intent to specify completely herein all the details of technical design and construction of material. However, the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.</td></tr>
<tr><td>2</td><td>APPLICABLE STANDARDS</td><td>The equipment covered by this specification shall conform to the requirements stated in latest editions & amendments of relevant Indian/ IEC Standards and shall conform to the regulations of local statutory authorities.
<table>
<tr><td>A</td><td>IS 9000</td><td>Basic Environmental testing procedure for electrical and electronic items.</td></tr>
<tr><td>B</td><td>IS 15707 : 2006</td><td>Testing, evaluation, installation and Maintenance of ac electricity meters — Code of practice</td></tr>
<tr><td>C</td><td>ASTM F 997</td><td>Standard Specification for Polycarbonate Resin</td></tr>
<tr><td>D</td><td>ASTM D792-08</td><td>Specific Gravity</td></tr>
<tr><td>E</td><td>ASTM G154</td><td>Exposure to UV radiations</td></tr>
<tr><td>F</td><td>ASTM B 117 - 09</td><td>Salt Spray Test</td></tr>
<tr><td>G</td><td>IS 15707 : 2006</td><td>Testing Evaluation installation and maintenance of AC Electricity Meters- Code of practice.</td></tr>
<tr><td>H</td><td>IEC 60068</td><td>Environmental testing.</td></tr>
<tr><td>I</td><td>CBIP–TR No.325</td><td>Specification for A.C. Static Electrical Energy Meters (latest amendment)</td></tr>
<tr><td>J</td><td>CEA Regulation : 2006</td><td>Installation and operation of meters Dtd: 17/03/2006 or latest amendment</td></tr>
</table></td></tr>
</table>

		K	Supply code	Delhi Supply Code 2006

3 CLIMATE CONDITIONS OF THE INSTALLATION

Sl. No.	Parameters	Specified Values
1	Maximum Ambient temperature	50ºC
2	Yearly average temperature	32ºC
3	Daily average temperature	42ºC
4	Minimum temperature	-25ºC
5	Height above sea level	1500-2200 Mtrs.
6	Max. relative humidity	100%
7	Min. relative humidity	10%
8	Average No. of thunder storm days per year	54 days
9	Average rainfall	118 cm
10	Max. wind pressure	130 kgs/m2
11	Average number of rainy days per year	106 days

The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.3 g.

4 GENERAL TECHNICAL REQUIREMNTS

S. No.	DESCRIPTION	REQUIREMENT
4.1	Material of seal	Polycarbonate grade 143R or equivalent
4.2	UV resistance properties	Should not get affected by UV rays
4.3	Boiling water, acid or chemicals resistance	Seal shall not be affect by boiling water, acid or chemicals
4.4	Seal wire	Seal should have 6 inch long 26 gauges, twisted strand stainless steel wire non-corrosive & non magnetic
4.5	Temperature Withstand	147 deg. Cel.
4.6	THICKNESS OF SEAL	Minimum 1mm thick
4.7	Serial number printing & visibility	Serial number should be laser printed on male & female part & should be separately visible after closing of seal

		4.8	Company MONOGRAM	Utility Monogram to be embossed as specified.
		4.9	Embossing quality	Embossing should have superior quality with good smooth finish.
		4.10	Seal design	Seal should be constructed/moulded with one piece twisted sealed wire & polycarbonate male & female part such way that no extra seal wire is required.
		4.11	Surface finish	The surface should be free from any burr or casting voids etc.
		4.12	Colour shade	The colour shades of all seals of specific color should be same. The color code will be provided by Utility.
5	**GENERAL CONSTRUCTIONS**	5.0.1 The seal shall be capable to withstand temperature upto 147 deg. C without any damage / deformation. 5.0.2 The seal shall be designed for a single use only and if tampered with the help of plier, knife or any other sharp instruments, the seal shall be damaged and due to its transparent property, the sign of internal tampering shall be easily detected. Also once opened, it cannot be re-used. 5.0.3 The seal shall be made in such a way that, it can be easily locked with the help of finger and thumb pressing no tools shall be required to close the seal in the laboratory or at site. 5.0.4 Both the parts shall be designed in such a way that they cannot be separated and the attachment shall be flexible and shall not break. After inserting the seal wire through female part, the cap of the male part shall be fitted in the female part in such a way that it should not leave any space to avoid insertion of any sharp tools for opening of seal body of the female part in hot or cold condition. 5.0.5 The seal shall have also the following features:- a. Tamper resistance and reliable. b. Environmentally safe as it does not contain any lead. c. Withstand long-term exposure to direct sunlight. d. Required no tools for installation. e. Transparent. f. Heat resistance.	
5.1	**Design**	5.1.1 The seal shall be anchor (Push Fit) type tamper evident with double locking. 5.1.2 There shall not be any change in size, shape or design of		

		the seal than the approved tender samples. If the seal is found different than the approved design / shape / size, the same shall be out rightly rejected. 5.1.3 The double anchor should not be so soft that it can be easily pressed before sealing, so that after pressing the seal cannot be opened. 5.1.4 The double anchor should be very hard such that it should not require plier to press fit. Should be easily press fit with hand/ thumb pressure. 5.1.5 The wall thickness of seal should be minimum one mm (1mm). 5.1.6 Seal shall be made of unbreakable, high grade, fire retardant reinforced Insulating material with FV0 Fire Retardant, self -extinguishing, UV stabilize, recyclable and Anti oxidation properties. 5.1.7 Non repeat seven digits Sr. No. With Code No. shall be laser etched / embossed during moulding (it shall not be screen printed) in contrast color on one side of capsule body (female). 5.1.8 The Sr. No. shall also be laser etched / embossed during moulding (it shall not be screen printed) in contrast color on top of the male part. 5.1.9 The laser etched printing shall be through complete thickness of the polycarbonate. **5.1.10** pole for inserting sealing wire of diameter of 1mm only with $\pm$ 0.1mm tolerance.
5.2	**Color of Seal**	5.2.1 The female portion of the Polycarbonate Seal(s) shall be available in Clear color and should be transparent (see through) type, which shall give complete visualization of its fixing mechanism and shall show clear indication if tampered. 5.2.2 Male part Anchor type body may be in colors of Red / Yellow/ Green/ Violet/ Orange or as per requirement of Utility. The color of seal should not fade with UV radiations of sunlight. 5.2.3 The color should be such that any two seals should not show any visual color shade difference. **5.2.4** The required shade of color shall be given/mentioned in the PO.
5.3	**Marking/ Monogram**	The seal shall have laser etched printing of monogram of Utility on front side and month and year embossed of manufacture in figure

<table>
<tr><td></td><td></td><td>on the backside. The laser etched printing should be through complete thickness of polycarbonate.</td></tr>
<tr><td>5.4</td><td>Seal material</td><td>The raw material used for polycarbonate plastic seals shall M/s GE plastic, (Grade 143R or 943 AA), any other equival manufacturer having similar material properties as under:

<table><tr><td>Sr. No</td><td>Item</td><td>Polycarbonate</td></tr><tr><td>1</td><td>Melting Temperature</td><td>2800 C to 2950 C</td></tr><tr><td>2</td><td>USE</td><td>Engineering</td></tr><tr><td>3</td><td>Softness</td><td>Hard</td></tr><tr><td>4</td><td>Durability</td><td>Weather effect resistant</td></tr><tr><td>5</td><td>Transparency</td><td>Fully Transparent (long time transparency)</td></tr></table></td></tr>
<tr><td>5.5</td><td>Seal Wire</td><td>The non-corrosive, non-magnetic stainless steel twisted wire (26 guage) confirming to IS : 280 shall be used . The seal wire shall not have effect of magnet i.e. it should not attract to magnet. The length of the sealing wire should be minimum 6” twisted two strand pull resistant stainless steel wire fixed to the seal. The diameter of each individual stand should be of 0.46mm (26 gauge) to 0.5 mm. dia and overall diameter of the seal wire shall be 0.92 to 1.0 mm (± 0.05). The No. of turns shall be minimum 20 per inch. The seal wire should be inserted at the female and male part during the process of moulding itself and with a visible projected and continuously length of the wire. The wire shall be intact such that it cannot be pulled out after sealing.
The seal wire insert hole should be just sufficient for passing the seal wire and hole of larger dia. is discouraged.</td></tr>
<tr><td>5.6</td><td>Tolerance</td><td>Any dimension Tolerance shall be max. 0.5mm or below.</td></tr>
<tr><td>5.9</td><td>Special feature</td><td>A secret code shall be given in each seal by bidder on whom the Utility places the order. The name of the bidder embossed/laser printed on the seals along with Utility logo, Sr. No., Month and Year of manufacture or any other symbol given by the Utility shall be embossed/ laser printed. Before commencing mass manufacturing & supply Six Nos. of sample seals of each color shall have to be approved from the purchaser.</td></tr>
<tr><td>5.10</td><td>Patent</td><td>Seals should be patented, or design is registered with patent office. Copy of patent certificate /lease & patent drawing/design should be submitted for verification along with the offer. This should comply to the latest CEA guidelines & its Bidders responsibility to provide genuine documents complying to statutory guidelines.</td></tr>
<tr><td>6.0</td><td>NAME PLATE AND MARKING</td><td>Seals shall have embossed marking clearly visible and effectively secured against removal. Following marking to be done on seals.
i. Manufacturer’s name on female part side below date & month
ii. Serial number – unique seven digit no (Seal serial number shall be laser printed on top of the male part & bottom of the female part).
iii. Utility monogram with logo on high-rise moulding in 8mm dia. On side of female part</td></tr>
</table>

		iv. Month and Year of manufacture in MM/YY format on other side of the female part in high-rise moulding in 8mm dia.
7.0	**TESTS**	All routine, acceptance & type tests shall be carried out on the seals separately in accordance with the relevant IS/IEC. All routine/acceptance tests shall be witnessed by the purchaser/his authorized representative. All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted
7.1	**TYPE TEST**	As per acceptance tests.
7.2	**ROUTINE TEST**	1. Dimension check – Dimensions as per approved GTP & within min. tolerances in specs. 2. Surface finish- Male & female part – The surface should be free from any burr or casting voids etc. 3. Embossing quality- embossing should have superior quality & good finish. 4. Colour shade- the colour shades of all seals of specific color should be same. 5. The steel seal wire shall be properly placed in insulating material.
7.3	**ACCEPTANCE TEST**	The seals shall be inspected / tested as a acceptance test at the manufacture's works before dispatch in presence of authorized representative of purchaser for the following tests: i) **Physical Dimensional Check-up :** The seals shall be subjected to visual check-up for verification of workmanship and other features as mentioned above including shape / design / dimensions as per approved drawing /Samples & dimensions should be within min. tolerances mentioned in specs./drawings. **ii) Boiling Water Test:** The seal when immersed in the boiling water for two hours there shall not be any effect on the seal and it shall remain intact condition i.e. the seal should not become soft, but instead should turn out to trail and easily break thus showing easily the tampering signs if it eventually happens. Even, with the help of any sharp instrument, pulling with plier i.e. by applying mechanical force, the male portion shall not come out from the female part (body seal). In case, it comes out, the same shall damage the seal, so that it cannot be re-used. **iii) Pull Out Test:** After locking the seal, if the male part / insert is pulled with mechanical force with the help of plier or any other instrument, sharp instrument etc. at normal condition, the seal should not get unlocked without any damage and when such condition occurs, it should leave traces of tampering. **iv) Seal Wire :** In case, if someone tries to pull the seal wire and in any of the tests as mentioned above at (ii) & (iii) in that case the male / female portion of the seal should be damaged and the same can be seen visually being a transparent one. **v) Chemical Test:** The seal be kept in the concentrated acid for minimum one hour. The same shall remain in tact condition and if try to unlock the seal, the same shall be damaged. vi) Temperature withstand test: The seal should be capable to

		withstand temperature up to 147 deg. C without damage/deformation. vii) **Effect of oil, chemical & sunlight :** The seal shall be so designed made that there shall not be any effect of temperature, chemicals, oil and sunlight etc. on the performance of the seal. Other checks - 1. Surface finish- Male & female part – The surface should be free from any burr or casting voids etc. 2. Embossing quality- embossing should have superior quality & good finish. 3. Colour shade- the colour shades of all seals of specific color should be same. 4. Marking & embossing - The LOGO embossing shall be as per Utility standard logo & making as mentioned in specs. The steel seal wire shall be properly placed in insulating material. In short, if the seal is tested for any of the above tests, in no condition the male and female part shall be separated out without affecting / damaging the seal. In case, if they are separated, the seal shall have sufficient tamper evident. Also, if seal wire is pulled out from the seal in any of the above tests, it shall not come out from the seal without damaging seal.
7.4	**Sampling Plan**	For carrying out above acceptance tests at manufacturer's works shall be Selected at the rate of 0.2% of the offered quantity with minimum 5 samples selected at random from the each lot offered as per IS4905. The seals used in testing shall be destroyed in the presence of Utility Inspecting Officer.
8.0	**TYPE TEST CERTIFICATE**	The bidder shall furnish the type test certificates of the meter for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI or ERDA or UL or accredited laboratory as per the relevant standards. Testing from any national approved laboratory or international acclaimed lab or equivalent will also suffice at the discretion of Utility. Type test should have been conducted in certified Test Laboratories during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to Utility.
9.0	**PRE-DESPATCH INSPECTION**	The successful bidder shall submit Six samples of each color seal (non-returnable) mentioned in tender/ PO for further testing and compliance as per specifications and getting approval before mass manufacturing. Out of Six samples, five samples to be submitted in Meter testing lab and one in Utility. Inspection may be made at any stage of manufacture at the discretion of the purchaser and if found unsatisfactory as to workmanship or material, the same is liable to rejection. Equipment shall be subject to inspection by a duly authorized representative of the Purchaser. Bidder shall grant free access to the places of manufacture to Utility's representatives at all times

		when the work is in progress. Inspection by the Utility or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by Utility. Following documents shall be sent along with material a) Test reports b) MDCC issued by Utility c) Invoice in duplicate d) Packing list e) Drawings & catalogue f) Guarantee / Warrantee card g) Delivery Challan h) Other Documents (as applicable) Stage Inspection: If desired by Utility, Utility will arrange stage inspection for the material used for manufacturing of seal and also during the process of manufacturing. If desired, during the surprise checking Utility shall take sample of raw material and will check for the material properties. In case, the same is not found as per the specification, the entire lot under process shall be rejected.
10.0	**INSPECTION AFTER RECEIPT AT STORE**	The material received at Purchaser's store shall be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection or approved GTP & drawings and one copy of the report shall be sent to the Utility.
11.0	**GUARANTEE**	Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the purchaser up to a period of at least 24 months from the date of commissioning or 30 months from the date of last supplies made under the contract whichever is earlier, Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Company, failing which the purchaser will be at liberty to get it replaced/rectified at bidder's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the bidder or from the " Security cum Performance Deposit" as the case may be.
12.0	**PACKING**	The bidder shall be responsible for suitable packing of seals, colour wise. The bidder shall have to supply each 100 seals in chronological order i.e. arranging in serially, tied with the steel wire forming a loop and same shall be packed in polythene bag with labels furnishing serial no., colour etc. & further packed in cardboard boxes for safety in transit.
13.0	**TENDER SAMPLE**	Bidders are required to manufacture 05 sample seals of each colour as per the Utility specification and submit (non-returnable) the sample along with bid for approval. These samples to be submitted in Meter Testing Lab & intimated to Utility. The tender sample seals shall be provided with trademark and logo of firm on front side & month and year of manufacturing on back side of the female part of the seal. The offer without samples shall be out rightly rejected and the offer shall not be considered.

		The samples seals shall be tested as per the specifications, either in Utility's laboratory or at third party govt approved laboratory, as per the discretion of Utility. The tender sample seals not conforming to the specifications shall be straight war rejected and accordingly, their offer will not be considered for further evaluation.
14.0	**QUALITY CONTROL**	The bidder shall submit with the offer Quality assurance plan indicating the various stages of internal factory inspections, tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and after finishing final product. Quality should be ensured at the following stages: • Inwards raw material • At Female part moulding along with seal wire • At male part moulding with seal wire • On finished product • Prior to packing The Utility's engineer or its nominated representative shall have free access to the bidder's/manufacturer's works to carry out inspections of QAP.
14.1	**IDENTIFICATION OF DUPLICATES**	Supplier shall ensure that process cannot be duplicated to prevent duplicate seals. However, in case Utility finds any doubtful seal at site, manufacturer shall visit the site for certifying whether the seals are genuine or duplicate. Manufacturer shall give a letter stating reason's for duplicate and technical report needs to be provided along with conclusions. A copy of the report should be sent to Plant Egg. Department.
15.0	**MINIMUM TESTING FACILITIES**	Bidder shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards/Utility specification. The bidder shall have good/digital/calibrated instruments to check minute difference in dimensions & logo etc.
16.0	**MANUFACTURING ACTIVITIES**	The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart shall be in line with the Quality assurance plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.
17.0	**SPARES, ACCESSORIES AND TOOLS**	Not Applicable
18.	**SEAL WITH TRACKING & RECORDING SOFTWARE**	As per relevant regulations, seal tracking and recording software for all new seals shall be provided by the meter manufacturer. The software shall have following features • Software should have facility of defining the system controller • Facility to enter serial number of seals with the help of bar code scanner. • Receiving of seal in the system and with authentication like signature. • Facility to identify the concern who is responsible for receiving of seals and nominated by system supervisor.

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Provision to define different type of seals for various uses.
Software should have facility of report generation for inventory & issue records.
Facility to track for relevant data for individual seal entered in the system.

</td></tr>
<tr><td>19.0</td><td>DRAWINGS AND DOCUMENTS</td><td>
Following drawings & Documents shall be prepared based on Utility specifications and statutory requirements and shall be submitted with the bid:
a) Completely filled-in Technical Parameters.
b) General arrangement drawing of the meter
c) Terminal Block dimensional drawing
d) Mounting arrangement drawings.
e) General description of the equipment and all components with makes and technical requirement
f) Type Test Certificates
g) Experience List
h) Manufacturing schedule and test schedule

After the award of the contract, soft copies or hard copies of following drawings, drawn to scale, describing the equipment in detail shall be forwarded for approval:
<table>
<tr><th>S. No.</th><th>Description</th><th>For Approval</th><th>For Review Information</th><th>Final Submion</th></tr>
<tr><td>1</td><td>Technical Parameters</td><td>√</td><td></td><td>√</td></tr>
<tr><td>2</td><td>General Arrangement drawings</td><td>√</td><td></td><td>√</td></tr>
<tr><td>3</td><td>Manual/Catalogues</td><td></td><td>√</td><td></td></tr>
<tr><td>4</td><td>Transport/ Shipping dimension drawing</td><td></td><td>√</td><td>√</td></tr>
<tr><td>5</td><td>QA &QC Plan</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>6</td><td>Routine, Acceptance and Type Test Certificates</td><td>√</td><td>√</td><td>√</td></tr>
</table>
All the documents & drawings shall be in English language.

Instruction Manuals (If applicable) : Bidder shall furnish softcopies and one hard copies of nicely bound manuals (In English language) covering instructions for use & application and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices if any.
</td></tr>
</table>

20.0 GUARANTEED TECHNICAL PARTICULARS

Sr. No.	PARTICULARS	TO BE FURNISHED BIDDER
1	Name & address of manufacturer	
2	Work's address	
3	Raw material of polycarbonate seals	
4	UV resistance properties	
	Seal shall not be affect by boiling water & acid	
5	Seal should have 6 inch long 26 gauges, twisted strand stainless steel wire non corrosive & non magnetic	
6	Max. Withstand temperature (upto 147deg.c.)	
7	Thickness of seal	
8	Serial number should be laser printed on male & female part & should be separately visible after closing of seal	
9	Embosing of monogram is as Per specification	
10	Colour of the seals	
11	Seal should be constructed/moulded with one piece twisted sealed wire & polycarbonate male & female part such way that no extra seal wire is required.	
12	Seal design should be such that once seal is closed, the two parts should not be separated.	
13	Seal should permanently secure steel wire inside seal after closing of male & female part.	
14	Seal should have positive locking & locking should be easy & should be possible with pressure of thumb.	
15	1. Surface finish- Male & female part – The surface should be free from any burr or casting voids etc. 2. Embossing quality- embossing should have superior quality 3. Colour shade- the colour shades of all seals of specific color should be same.	
16	Guarantee of seal	
17	SEAL IS PATENTED (Provide patent n & patent drawing/design along with	

				COPY OF PATENT certificate.	
			18	Seal wire details	
			19	Supplier should have supplied minimum 1 lakh such seals to power utility. Give details.	
			20	a. Color of female part b. Color of male part	
			21	Manufacturer specific secret code - (Yes/No)	

21.0 SCHEDULE DEVIATIONS

(TO BE ENCLOSED WITH THE BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

S.No.	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation

22 AUTHORISED SUPPLY UNDERTAKING

(TO BE ENCLOSED WITH THE BID)

On award of contract the bidder should not sell or offer the seals with Utility logo to any unauthorized person outside Utility in any circumstances.

We confirm that we or any our company representative shall not offer to sell the Utility logo seals to any unauthorized person outside Utility.

Seal of the Company:

Signature

Designation

Sd/-

General Manager Ele.,
DAS, SG & TIC
BESCOM.

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